same time for judgment. The tongue was used only when free of the effects of eating, drinking, or smoking, and was carefully rinsed. It was found best to test but a few substances per day, and these were of course varied in order, and arranged to avoid prejudgment. The number of taste organs stimulated, which Camerer found to affect the number of right guesses, does not seem to have been fixed beyond the using each time of the same quantity of the solution. In trying to fix the weakest solution of acids that could be distinguished from pure water, the experimenter found that with the same acid it varied at different times, probably with his own condition, from 3 to 35 parts in 10,000. It is possible, however, to compare weak solutions of the same or of different acids with a good deal of exactness if the experiments are made as nearly as may be at the same time. It was found that for solutions of chlorhydric acid ranging in strength from 15 to 25 parts in 10,000, a difference of 6 parts was distinctly perceptible; under exceptional circumstances, for solutions containing between 3 and 15 parts of acid in 10,000, a difference of 3 parts could be recognized. The portion of the research that bears directly on the connection of tastes with the chemical character of the acids, consisted in arranging variously proportioned standard solutions of the different acids in the order of their sourness. The results were consistent for both mono and polybasic acids, and are as follows: (1) the intensity of the acid taste is not the same for all the acids at the same degree of dilution, *i. e.* the same weight of acid diluted with the same weight of water; (2) the intensity of the taste is not proportional to the amount of replaceable hydrogen in the solution; (3) the taste of solutions containing each the same number of molecules of acid is stronger as the weight of the molecule is less. Whence it is concluded, (4) that "the intensity of the acid taste of a molecule of any acid depends on the relation of the weight of acid hydrogen contained in the molecule to the weight of the molecule." The order of the acids thus arranged is that given above. The experiments were all made by the author upon himself, and he recognized an educative process from the experiments in his power of discrimination. E. C. S.

Beobachtungen über die Geschmacksempfindungen nach der Zungenexsterpation. N. CYBULSKI and A. BECK. Transactions of the Academy of Sciences of Cracow, 1888; noted in Centralbl. f. Physiol. No. 12, Sept. 15, 1888.

These experimenters found in a patient whose whole tongue, including the basal taste papillae, had been removed, that there yet remained some ability to taste. The sensations of sweet, bitter and sour could be caused by touching the back of the throat or the mucous surface of the stump of the tongue with appropriate substances, though in the latter case they were only perceived when movements of swallowing were made. The taste of salt could not be excited.

Die Einwirkung der Kohlensäure auf die sensiblen Nerven der Haut. GOLDSCHEIDER. Verhandl. der Physiol. Gesells. zu Berlin, Nov. 25, 1887.

When the hand is plunged into a vessel of carbonic acid, a sensation of warmth is felt. This increases for a time and then declines.

At the suggestion of du Bois-Reymond the author undertook an investigation of the phenomenon. After excluding more or less completely by experiment or well known physical principles the possibility of the sensation being due to the dampness of the gas, its conductivity, its heat capacity, its absorbent power, its setting free heat in its absorption in the moisture of the tissues of the skin and its causing an elevation of the skin temperature by dilation of the small blood-vessels, he concludes that it is really due to an actual chemical stimulation by the gas of the nerves of warm sensation.

Thermische Experimente an der Küchenschabe (Periplaneta orientalis). V. GRABER. Arch. f. d. ges. Physiol. XLI, abstract by Hermann in Jahresb. Anat. u. Physiol. Bd. XVI, Abth. 2, 1888.

The limits of temperature fatal to these roaches are —6° C. and 41°. With decreasing temperature, at about 5°, they lose locomotion and, if they remain at that temperature, other power of motion also. They will still respond, however, to strong stimulation. Below 0° they soon become paralysed, but recover more or less perfectly when warmed again. At —5° or —6° they die in from 10 to 20 minutes. Increasing temperature makes them more lively; above 37° they go into convulsions, and die slowly at 41°, though for five minutes or less they can bear 60°. Graber tested the temperature preferences of these animals by an apparatus of three connecting chambers, the two outer ones of which were of variable temperature. If the side chambers were both high, say 38°, the insects all stayed in the middle one. If they differed by about 2° and were still high, most of the animals chose the cooler. If the side chambers were both cold, they picked the warmer. The roughness and conductivity of the floor were of great influence. The "optimum" or temperature of greatest preference was about 26° or 28°, but at this very point the animals were frequently uninfluenced in their choice by wide differences of temperature. When offered a very hot chamber and a very cold one, they preferred the hot one up to about 39°, or only went into the other for a little while to cool off. When the hot chamber was yet hotter, they preferred the cold, even if below zero. Strange to say, they did not in these experiments remain in the middle chamber.

Die räumliche und zeitliche Aufeinanderfolge reflectorisch contrahirter Muskeln. Dr. WARREN P. LOMBARD. Separat-Abzug aus Archiv f. Anat. u. Phys. 1885.

To know a reflex act one must know the muscular contractions that enter into it and their order and extent in space and time. Such an analysis Dr. Lombard made for the reflex contraction of the muscles of a frog's leg. He found that the reflex called out by a continuous heat-stimulation was not a continuous contraction, but one broken by periods of rest; also that the order of contraction of the muscles in a series of reflexes was not constant; that, other things being equal, the number of muscles excited, and the length of time required for the stimulus to spread to all the motor roots, varied with the kind and intensity of the stimulus. From these he concludes that there must be somewhere in the central portion of the centripetal-centrifugal arc an apparatus that holds back the